Surgical Snapshot
Neurosurgery

Normal Pressure Hydrocephalus

ASSETs
Australasian Students' Surgical Education Tools

Introduction	Normal pressure hydrocephalus (NPH). A common causes of gait disturbance in the older adult. Managed with CSF shunting, usually a via a **ventriculoperitoneal shunt (VP shunt)**. A VP shunt is highly effective treatment for carefully selected patients (ensure diagnosis prior to intervention). Importantly, the number of patients with dementia and ventriculomegaly outweighs the number of patients with true clinical syndrome of NPH .
History	Primary problem is **gait disturbance**, followed by **urinary incontinence** and **neuropsychological deterioration**. These three symptoms occur not only in this order, but also order of severity. Not all patients will have all three. Triad: mnemonic 'wet, whacky, wobbly' Important differentials • **Dementia** (neuropsychological problems usually lead in time and severity, but can present with both NPH + dementia) • Cervical myelopathy • Spinal tumour • Deep white mater ischemic changes • Aqueductal stenosis
Examination + investigations	Full neurological examination Gold standard = **MRI B**, CTB is inferior • **ventriculomegaly,** • +/- **acute callosal angle** (a characteristic ventricular shape seen on the coronal view, where corpus collosum is angled acutely in the midline), • +/- dilated subarachnoid spaces • +/- white matter changes around the margins of the ventricles (may indicate CSF being pushed back into the ventricles) Lumbar puncture • Opening pressure is usually **normal** (e.g. not elevated, <20 mmHg) • Pressures towards the upper limit of normal is supportive, however even in the mid-range can be compatible with the dx • Patients usually improves post LP, this is meaningful in predicting a favourable response to VP shunt insertion. However as usually only

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	draining approximately 30 mL out 300 mL CSF, there is understandably a substantial **false negative rate** in predicting a favourable response to VP shunt insertion.
Preoperative considerations	Consenting patients for VP shunt need to involve discussion about • Estimate of success rate, aligning patient expectations that surgery may not result in return to full normality (90% chance of meaningful improvement) • Possibility of complications (see post-operative considerations) • Increased risk of post operative bleeding (particularly subdural) for those on **anticoagulants or aspirin**. Patients must be able to cease these prior to surgery, can be restarted usually two post-operative if required.
Key procedural points	Patient positioned with head on a cushioned **horseshoe head rest**. Rotate head away from the site of shunt insertion. Shunt usually inserted in the **parieto-occipital region**, on the **non-dominant hemisphere** (usually the right, to avoid damage to speech areas in the dominant hemisphere, usually the left). Shunt inserted with **computer/imaging guidance** in the operating theatre. Shave, prepare and drape both wound sites, the cranial site and the abdominal wound. **Cranial wound** involves drilling a **burr hole**, opening the dura and obtaining a small area of haemostasias on the gyrus underneath. **Abdominal wound** involves penetration of the anterior rectus sheath, split the rectus muscle, posterior rectus sheath and peritoneum. Once entry into peritoneum confirmed, the surgeon will tunnel a **subcutaneous tunneling device** from the cranial wound down to the abdominal wound. Then pull the peritoneal catheter through the tunneling device and the valves are connected. Then the catheter is inserted into the ventricles under imaging guidance for accurate placement. Note at which depth CSF first dripped out the catheter. Trim the catheter, attach to the cranial valve. Ensure valve positioned nicely under scalp prior to closure. Ensure CSF drips out peritoneal catheter prior to closure of abdominal wound. Usually, the surgery takes one hour.
Relevant Anatomy	The layers of the scalp. Mnemonic 'SCALP' S = **Skin** C = **Connective tissue** (**dense**) A = **Aponeurosis** (occipitofrontalis or galea aponeurotica) L = **Loose** connective tissue P = **Pericranium**

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	Also revise the layers of the abdominal wall.
Post-operative considerations	Post-operative plan • **Close neurological observations**. Start with 0.5 hourly upon return to ward for 2 hours, hourly for 4 hours, then two hourly overnight. • Mobilise day 1 post op as appropriate for the individual. • Some severe cases may require rehab, if mild to moderate can go home after day 2. **Complication rate is considerably low.** Intraoperative complications • Hemorrhage, injury to surrounding anatomy. E.g. acute bleed at site of shunt insertion, risk is 0.5%. • Anesthetic risks • **Primary shunt malfunction or blockage**: e.g. due to misplacement, blood clotting in the valve Early postoperative complications • Infection: superficial wound infections, intra-abdominal collections, URTI, UTI. **Antibiotic impregnated catheters** for the VP shunts are used to mitigate some of this risk. • As major surgery: DVT, PE, MI, Stroke Late postoperative complications • **Secondary shunt malfunction or blockage**: e.g. may migrate out of place (both top or bottom end) • **Subdural collection** due to valve causing over drainage of CSF. Risk is mitigated by more modern valve design, was more common with older valves.

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